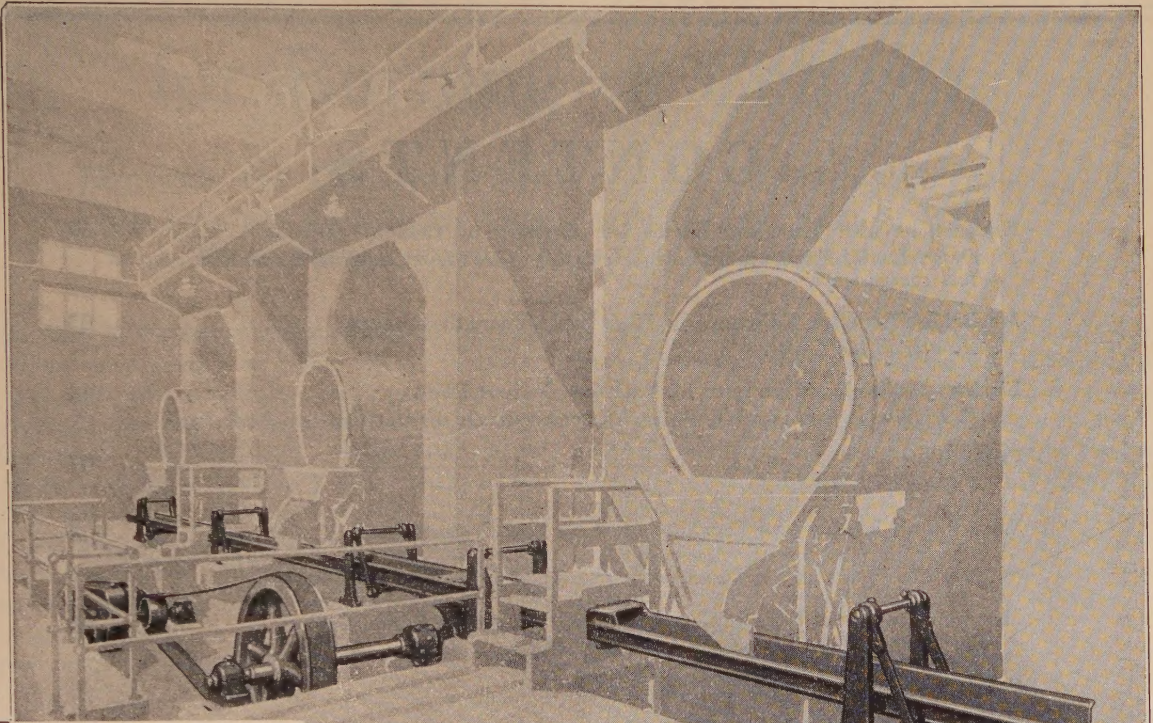
CEMENT MILL SECTION of

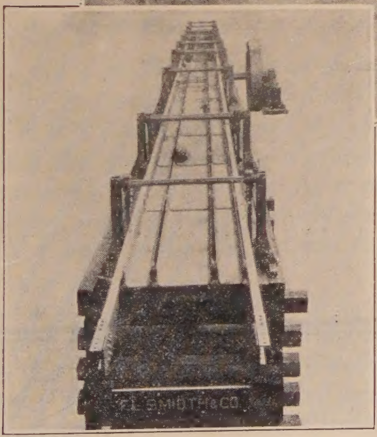
Concrete

THE SKIPULTER

(Trade Mark Reg.)



A Skipulter installed in a western cement plant, where it is conveying cement clinker, discharged from three coolers, to an elevator



Triplex Skipulter for conveying three different materials between the same or different stations

FLS

THE Skipulter is an improved type of shaker conveyor for transporting coarse materials, such as cement clinker, coal, ore, slag, rock, limestone, etc.

It consists of a steel trough, suspended by pendulums, actuated through a flywheel and eccentric into an intermittent forward and backward motion. No springs or rollers are employed. The transported material is rapidly and constantly carried forward to point of discharge.

The Skipulter can be arranged to receive different materials at different feed points at the same time, either mixing them or keeping them separated during the transport as desired. And, the discharge can be arranged at either end of the trough or at various intermediate stations as required.

This type of conveyor is one of the simplest means of conveying materials, economical to operate, requiring very little horsepower, and is a simple solution to many conveying problems.

F. L. SMIDTH & COMPANY

Engineers

225 Broadway New York, N. Y.

CEMENT MILL SECTION of

Concrete

The Cement Mill Edition of Concrete is edited exclusively for those interested in the manufacture of portland cement. Its pages are devoted to discussions of plant design, management, operation, production efficiency, chemical research and control, quarry operation, progress and news of the industry.

The Cement Mill Edition also contains all the material published in the corresponding Regular Edition and so provides news of the uses and merchandising of the materials whose manufacture is discussed in the Mill Edition. The Regular Section furnishes mill operating officials and mill executives valuable points of contact with the users of the materials they produce.

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CEMENT MILL SECTION of

Concrete

Vol. 39 Chicago, September, 1931 No. 3

Experiment With Traveling Grates for Burning of Cement

Methods for Complete Sintering on Traveling Grate—One Process Combines Grate with Short Rotary Kiln—Fuel Requirements Considerably Reduced

THE kilns used in the manufacture of cement are generally either vertical-shaft or rotary kilns. A disadvantage of the shaft kiln is found in the irregularities in burning, while in the case of the rotary kiln the high fuel consumption is a disadvantage. Many experiments have been made in order to develop a burning apparatus possessing the advantages of both the vertical and the rotary kiln, but without the disadvantages of either. In the following notes the use of the traveling grate as used in the metallurgical industry for the calcination and reduction of ores is examined, for the uses of the grate in this industry suggest its adaptability to cement manufacture.

Reduction of Ores

The ore is fed to the grate in an even layer, and travels through the furnace on the grate. If the ore is to be reduced it is previously mixed with coal, and air is drawn through the grate, causing combustion of the coal and reduction of the ore if there is a surplus of fuel and a scarcity of oxygen. Alternatively the furnace may be next to the grate and the flame taken through the grate and the material lying on it.

In the first case it is advisable to force the air through the grate from underneath, so that the fresh air cools the grate efficiently. In the other case the reverse process is used. The gases transfer their heat to the top layer of material on the grate, and will come into contact with the grate only when they have cooled down. To obtain even burning in spite of this, a layer of ready-burnt material is interposed between the grate and the fresh material. It is then possible to heat the whole layer of new material to a temperature sufficiently high for the process, without endangering the grate.

There are a number of similar processes in use where the material and the fuel are put on to a grate in separate layers or already mixed. These processes have all proved successful except where the material is inclined to melt or to become sticky. The grate in such cases is useless, as the individual links become stopped, the movement of the grate is impeded, and regular gas-passage becomes impossible. This regular gas-passage and the resulting close contact of all parts of the material are the main advantages of the grate as compared with other burning devices. The layer of material must at all points have the same resistance to the passage of gases, as otherwise uneven heating results.

Arrangement for Burning Cement

The questions arising when this process is contemplated for burning cement or similar products are here explained with the aid of practical examples. Fig. 1 shows a plant with a traveling grate for burning cement. The raw material is fed to the grinding mill from the hopper A and the mill discharges the material on to the conveyor R. Coal is fed from the bunker D in regulated quantities on to the same conveyor. After passing the pug mill E and the hopper F, the mixture is fed to the traveling grate in an even and regulated layer. In front and at the back of the hopper F are hoppers S and T. Hopper S is filled with fully-burnt clinker and a little coal, while hopper T contains coal only. In this way three distinct layers are formed on the grate V; the lower layer consists of the clinker-coal mixture, the second and main layer contains the raw material, and the thin top layer consists of coal. Chambers are arranged above and below the grate, and air from the atmosphere is drawn through the upper chamber and the grate with its layers into the lower chamber, the fan being connected with this lower chamber. A device for the ignition of the top layer of coal is arranged at the point of entrance of the grate into the chamber, and as the grate moves on the whole of the material on the grate ignites.

As with all other grates the contact of the gases with

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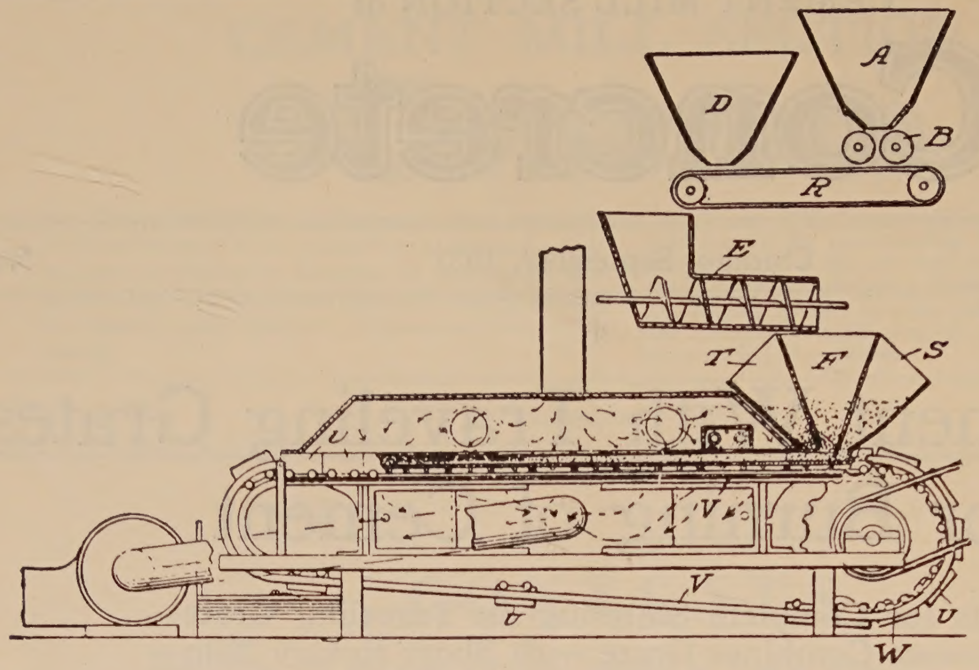


Figure 1. Typical arrangement for burning cement

the different parts of the material is regular, at least as far as horizontal distribution is concerned. With parts lying one on top of another the matter is more difficult. The cold air first comes into contact with the coal, is here heated to a high temperature, and then passes on to the upper part of the mixture of raw material and fuel. The ratio of fuel and material in this mixture must be such that the heat produced by the fuel in the mixture balances the heat consumed in burning the raw material. By suitable adjustment of the mixture this balance can be achieved reasonably exactly, so that the temperature of the gases is not subjected to change. The gases finally reach the bottom layer, where in heating the clinker they will part with enough of their heat to eliminate the danger of burning the grate.

The burning process must be finished by the time the top layer of coal has burnt away, as the air meeting the material direct will not be heated sufficiently and will only serve to cool the clinker. The thermal efficiency in this case is very poor. The heat contained in the clinker is not utilized, but escapes into the atmosphere. This can be adjusted by the arrangement of a special cooling section through which the air used for combustion is previously passed.

Difficulties About Utilizing Waste Heat

The hot waste gases are also not utilized. It is therefore of no importance that the gases are cooled to a certain extent by heating the clinker which forms the bottom layer on the grate. Similarly the heat in this clinker is wasted. It has therefore been suggested that the waste gases should be used to heat the material previous to its burning, and for this purpose the chamber underneath the grate should be connected with a further chamber over the grate and in front of the burning-zone; the waste gases are drawn through this chamber and through the fresh material on the grate. Such an arrangement, however, has its drawbacks. The insulating layer of clinker must be of sufficient thickness to prevent damage to the grate, and so the clinker will carry away with it the most valuable part of the heat of the waste gases. Moreover, the pre-heating of the material must be done very carefully, as ignition of the fuel mixed with the material must of necessity be avoided.

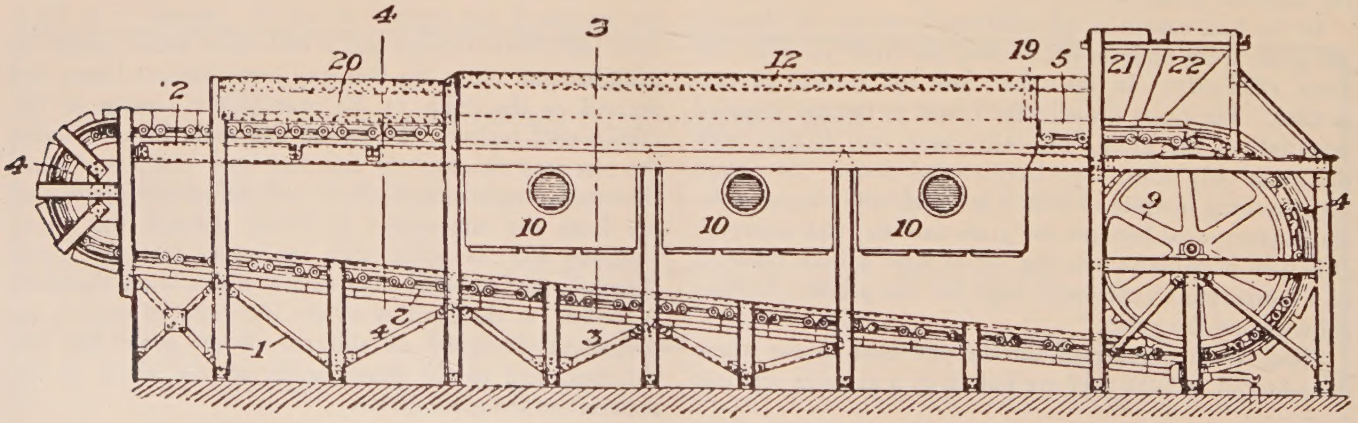


Figure 2. Arrangement similar to that in Figure 1, but employing external source of heat

Apart from these disadvantages, the principle of the process is easily vulnerable. The cement clinker on the grate is first calcined, and sintered at a later stage. As cement at the sintering stage is inclined to become viscous, the resistance represented by the layer of material to the gases increases, and sometimes this prevents air-passage altogether, so that underburnt clinker is obtained. As far as is known no such plant has been worked for any length of time.

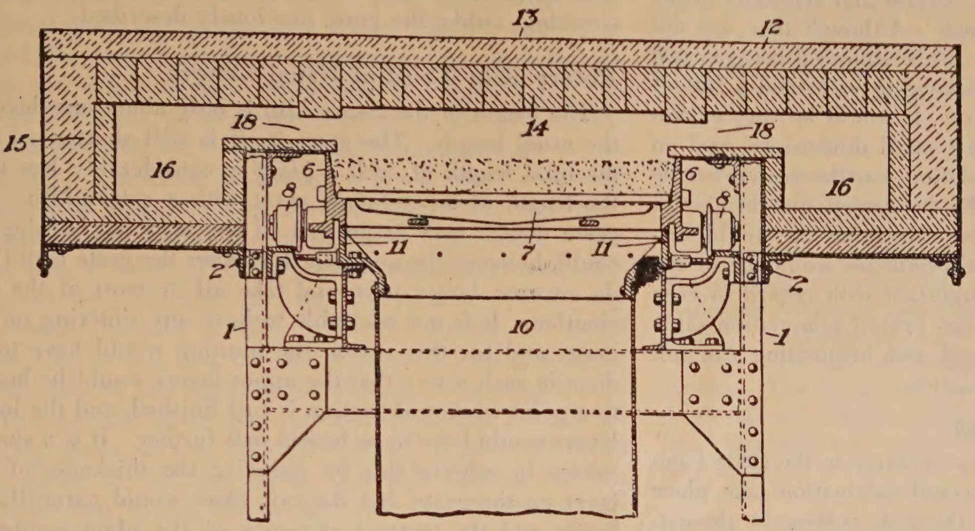


Figure 3. Cross-section through installation shown in Figure 2

Employing External Sources of Heat

A plant on lines similar to Figure 1, but with an external source of heat, is shown in Figs. 2 and 3. The plant is mainly used for burning lime; here the difficulties are fewer, but the burning of cement has been considered. Here there are also several bunkers (21, 22), at the feed-end. The hopper 22 supplies the insulating layer of burnt material, while 21 contains the raw material. The flame is produced in a special chamber, 16, at both sides of the grate (see Figure 3), and enters into the combustion area 14 (over the grate) through the flues 18. One or more suction chambers are arranged underneath, the larger number allowing subdivision of the whole burning apparatus. The quantity of gas sucked through the individual chambers can in this way be regulated.

A variation of this process can be obtained by the admixture of part of the fuel to the material instead of burning the whole in the chambers 16. If all the heat is produced in these chambers the upper layers on the grate will be heated with greater intensity than the lower parts, and uneven burning will result. If part of the fuel is in the material the heat expended in heating the upper layers can be compensated by the fuel in the material, in the same way as in the process described previously. Otherwise the process is the same. Here also a cooling and a pre-heating section can be installed, leaving the plant with the same weaknesses. The greatest difficulty is always the viscosity of cement clinker at the sintering stage.

The Lellep Process

A solution was provided by Lellep with his combined traveling grate and rotary kiln. He does not attempt to do the sintering on the grate, but leaves this to the rotary kiln, where it is a simple matter. The process is as follows: The material is preheated and calcined on the grate and is finally sintered in the rotary kiln adjoining

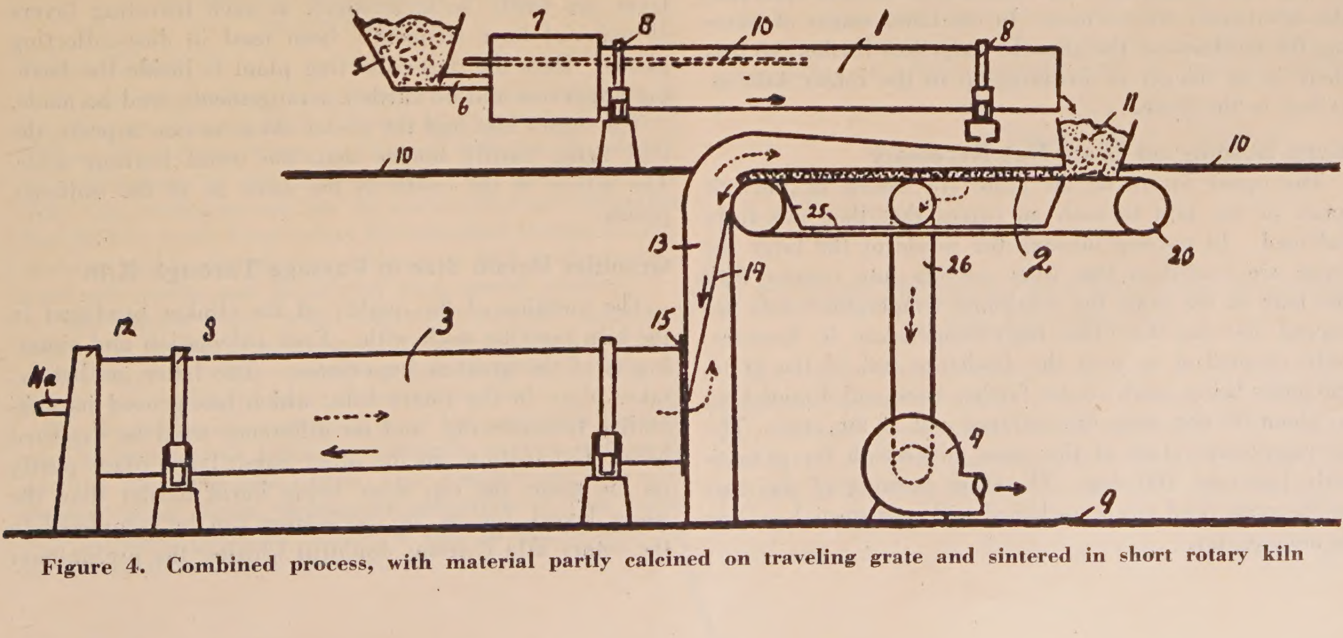


Figure 4. Combined process, with material partly calcined on traveling grate and sintered in short rotary kiln

the grate. As the rotary kiln has only part of the usual work it can be accordingly shorter in length. The general arrangement is diagrammatically shown in Fig. 4. The dry and finely-ground material is first granulated and put, in the shape of small balls, into a rotating cylinder. This is effected by adding moisture to the meal in the shape of drops of water which cover themselves with meal and increase in size with further rotation of the drum. The size of these granules is fairly regular and generally grows to a diameter of about ½ inch. Although they are not as strong as briquettes—they can be squeezed between two fingers—they are sufficiently strong to withstand a fall of several yards without breaking. It would be very expensive to form briquettes of such small dimensions, and no doubt the cheapness of granulation was the reason for its choice, although it will hardly be denied that briquettes would show many advantages. Breaking up would certainly be avoided, and all the briquettes would be of the same size. This would be important with regard to even burning. Practice, however, has proved granulation satisfactory for conditions imposed and briquetting can not be carried out on account of price.

Heat of Kiln Gases Utilized

The granules are fed in an even layer to the grate from a storage hopper, and drying and calcination take place on the grate. The heating of the grate is done by the exit gases of the rotary kiln, the gases meeting the material on the grate from above and being sucked through the grate. A suction-box which can be subdivided is arranged underneath the grate, and the apertures between the links of the grate are made so small that no granules can pass through. At this juncture the value of granulation becomes clear. If it were not for the granulation the material would be sucked through the grate; that is, with the usual rotary-kiln feed. As the granules retain their strength even after evaporation of their water-content and calcination, only negligible quantities of material pass through the grate. The evenness of burning with these granules is considerably improved compared with ordinary kiln practice, where dust as well as larger pieces have to be burnt. On the other hand, the undisturbed state of the granules on the grate prevents breaking up, as this danger no doubt exists during the drying period and at the beginning of the calcination period. Comparing these conditions with ordinary rotary kiln practice, the advantages are obvious. In the latter stages of burning the hardness of the granules improves further, so that there is no danger of breaking-up in the rotary kiln attached to the grate.

Even Burning on Grate Not Necessary

The upper layers on the grate are heated by the exit gases of the kiln to such an extent that they are fully calcined. In passing through the whole of the layer the gases are cooled so that when coming into contact with the bars of the grate the maximum temperature does not exceed 550 deg. C. This high temperature is, however, only reached at or near the discharge end of the grate, the gases being much cooler farther back and diminishing to about 50 deg. near the entrance end of the grate. The average temperature of the gases underneath the grate is only just over 100 deg. Therefore burning of the bars of the grate need not be reckoned with and special cooling is unnecessary.

It has been mentioned that it is difficult to achieve even burning on a traveling grate; by heating from an external source the top layers will be burnt better than the lower layers. This characteristic of the traveling grate in the present case is of no importance, as even burning is intentionally relinquished because the final burning is done in the rotary kiln together with the sintering. The grate has nothing to do with the sintering of the clinker, and is consequently not loaded with the difficulties inherent in sintering, unlike the grate previously described.

Rotary Kiln Third of Usual Length

The length of the rotary kiln is only about one-third of the usual length. The grate itself is still shorter, so that the total length of such a plant is considerably less than the length of an ordinary plant with a rotary kiln. The grate does a very large part of the work of burning; it could, however, be questioned whether the grate could not do an even larger part, and take all or most of the calcination. It is not advisable to have any sintering on the grate, and for this reason the burning would have to be done in such a way that the upper layers would be heated to a point where calcination is just finished, and the lower layers would have to be heated still further. It is a simple matter to achieve this by reducing the thickness of the layer on the grate, but the exit gases would naturally be hotter and the thermal efficiency of the plant would be lower. This could be remedied by passing the gases through a special preheating zone instead of straight to the chimney, but the grate would be exposed to higher temperature and would need special cooling. The whole plant would thus become fairly complicated. There seems to be every justification for doing without the increased load of calcination on the grate, even if this appears to be at the expense of a slightly longer rotary kiln.

How the Kiln Dust Is Eliminated

The grate incidentally solves the difficulty of dust-trouble associated with ordinary rotary kilns. The dust carried up the rotary kiln by the gases is caught in the layer of granules, which acts as a filter. There is no fine dust which can be sucked through the apertures and slots of the grate and practical experience has shown that the gases entering the chimney are dust-free. Here again the value of a granular material is shown. This effect of the layer can easily be understood, as such traveling layers of material have frequently been used in dust-collecting plants. Here the dust-collecting plant is inside the burning apparatus and no further arrangements need be made.

The rotary kiln and the cooler show no new aspects, the kiln being hardly longer than the usual burning zone. The action of the cooler is the same as in the ordinary plants.

Granules Retain Size in Passage Through Kiln

The question of the quality of the clinker produced in the kiln must be dealt with. Even calcination and sintering is of the greatest importance. The latter, as before, takes place in the rotary kiln, which has proved its suitability for sintering, and no difference need be expected here. Calcination, on the other hand, takes place partly on the grate, the top layer being burnt harder than the lower layers, but as the calcination can be completed in the rotary kiln it seems doubtful whether the preliminary irregularity of burning affects the final quality of the clinker. In any case it can hardly be of importance, as even with the ordinary rotary kiln mixing of burnt and raw material takes place occasionally when rushing of raw-meal occurs without any detrimental effect on the quality of the cement. There is, however, one important advantage which influences the quality of burning. The material retains its size until leaving the kiln, and on the whole journey through the kiln. Tests carried out with material made in this kiln have shown that it is equivalent to ordinary rotary clinker, compression strength being the same and tensile strength being slightly improved.

The following results were obtained at the first experimental plant at the Ruedersdorf Portland cement works, Guthmann & Jeserich, Kalkberge i. Mark, where a disused rotary kiln with a very small cooler has been employed. Results in new plants can be expected to be better. The coal had a value of 6,450 calories and contained 12.5 per cent ash. The raw meal had 76.5 per cent $CaCO_3$ and a moisture content of 13.5 per cent. Excess air varied from 1.05 to 1.1, and the heat consumed averaged about 1,045 calories per kilogram of clinker. The temperature underneath the grate was not measured, but behind the fan the gases were at 105-110 deg. C. It was calculated that about 28 per cent of the CO_2 contained in the raw material was driven off on the grate, the rest being calcined in the kiln.

Summary of Advantages

To sum up, the main advantages of the Lellep process are as follows: clinker of a quality corresponding to rotary-kiln practice is produced with a fuel consumption considerably less than with ordinary rotary kilns, and even lower than with vertical-shaft kilns. At the same time the exit gases are cleaned so that they carry no dust, and the space occupied by the plant is less than in the case of an ordinary rotary kiln.

We are indebted to Messrs. G. Polysius, A.G., Dessau, Germany, for the foregoing information.

MacBride Discusses Editorial on High-Early-Strength Cement

Product Must Acquire Full Service Strength in 24 Hours—Manufacturing Pitfalls to Be Avoided

Editor, CONCRETE:

A note of prophetic certainty marks your editorial in the August *Cement Mill Edition* of CONCRETE, entitled, "When High-Early-Strength Cement Becomes Standard," as a milestone in cement progress. We agree with you that "the prediction can now be made with some assurance that in five years from today the standard cement in general use will be the kind now known as high-early-strength portland cement and thought of as a special product."

The reason why true high-early-strength portland cement is destined to displace present ordinary portland cement is that where concrete requirements are high, its proper use results in lower construction costs.

We do not have to rely upon good but intangible reasons such as time-saving, public convenience, earlier occupancy and the like. The one reason, plus competition, that will quickly bring about widespread adoption of true high-early-strength portland cement is that structures may be fabricated therewith at lower cost.

Cost is used in a broad sense. On some classes of construction contractor job costs are lowered. On others, the total of owners', users' and contractors' costs are reduced. The net of the situation is that when high-grade concrete is required, the use of high-early-strength portland cement is an economy.

True high-early-strength cement produces full service strength in 24 hours and after normal setting periods. Only service strength in 24 hours produces cost savings. Such strengths in 48 hours and 72 hours promote convenience and speed, but seldom show actual cost savings. This latter is the only true basis upon which a product which requires a higher sales price can be successfully sold.

Your observation that "ever since it became known that high-early-strength cement can be made at one burning by the use of longer kilns, the trend has been in the direction of long kilns" is not in accord with the experience of the Lone Star Cement companies. In the Houston plant of the Texas company and the New Orleans plant of the Louisiana company are kilns which can be truly classed as long—approximately 400 feet in length.

Long kilns are of value in the production of good clinker. The Lone Star companies have been unable, in single burned clinker, regardless of kiln length, to secure the refinement of composition which has been found necessary for a true high-early-strength portland cement.

It should be noted that intense burning, even in extremely long kilns, has its limitations in the formation of compounds which make true high-early-strength cement possible. Progress beyond single burn limits has been made only through the introduction of some other factor; the most dependable and economical means which has been developed, so far as we are aware, is re-exposure and re-arrangement of the minute particles through grinding, and refinement in composition through reburning.

Fine finish grinding merely develops the inherent possibilities of the clinker. At equal fineness the better made clinker produces the better cement. Composition and processing of the clinker therefore hold the answer to the problem of producing a true high-early-strength portland cement.

In order that the development of high-early-strength portland cement be uninterrupted, it is felt that manufacturing pitfalls must be avoided. It is believed that only a product, the use of which produces profit to the user, can gain the widespread recognition which has been prophesied. All facts now available indicate that the latter is only possible through a portland cement producing full service strength in not more than 24 hours.

Your vision and the candor with which it is expressed are most commendable. The industry may well profit by your ability to isolate a problem and to define it clearly.

D. S. MACBRIDE,
Manager, "Incor" Division,
International Cement Corporation.

New York City,
August 17, 1931.

J. B. John Assures Manitowoc Workers of Stable Wages

The trophy dedication program held at the Manitowoc Portland Cement Company plant at Manitowoc, Wis., on July 16 was punctuated by the declaration of General Manager J. B. John that the wage scale paid cement plant workers will not be reduced except in a situation of dire emergency. Dividends to stockholders have been eliminated and salaries of officials have been reduced, he said.

Finding Undeveloped Sources of Fuel for Cement Plants

Final Article of Series on Low Grade Fuels Describes Additional Sources of Supply—Methods of Treatment for Use in Burning Cement

By E. T. ELLIS, F. J. I.
Ecclesall, Sheffield, England

THIS final installment of this series of articles is a continuation of that in the August issue, in which the writer pointed out the availability of certain low grade fuels of the short flame class, and explained how this type of fuel may be mixed with better grades.

Hard Coking Bituminous Coal Mine Bank Waste

Cement men are almost certain to be able to get hard coking bituminous coal mine bank waste in large quantities for direct or indirect firing. Here again it is advisable only to buy the best waste in a dry state, for otherwise much capital will have to be expended in getting rid of moisture. Assuming that it is delivered in a dry state, poor samples of it should show on analysis not less than 64 per cent of fixed carbon, while good samples will reveal the presence of up to 74 per cent of this. As regards the total carbon content, with the bituminous coals this includes a big proportion of the volatile matter; that is, the volatile matter is made up of sundry hydrocarbons mostly. The best samples of hard coking bituminous coal mine bank waste, so far as cement concerns are affected, should contain not less than 79 per cent of total carbon, while if 89 per cent is revealed by ordinary analytical methods, so much the better. The hydrogen content is not very different from that of some of the other low grade fuels discussed in last month's issue. Buyers should specify that it shall not be less than 4.5 per cent nor more than 5.5 per cent.

Regarding the volatile matter content, this should be carefully watched, and should be estimated at 900 deg. C. In suitable samples of hard coking bituminous coal mine bank waste for cement mills, 29 per cent should be the constant, but sometimes samples come into the market with very much less, and occasionally parcels can be picked up containing slightly more. The ash content, provided that the coal mine bank waste is thoroughly picked over before delivery, is small, as a rule, while the calorific value is variable, and as a rule is moderate, unless the low grade fuel is briquetted and carbonized, when it is decidedly good.

The modus operandi need not be very elaborate. Aim at eliminating ash as completely as possible, small though it usually is, and aim at increasing the fixed carbon content rather than the total carbon content. This is only done at the expense of volatile matter, and may be effected in two ways. First, by partial carbonization, usually after the loose stuff has been briquetted alone, just as it is with the aid of a small portion of water gas pitch or similar binding agent; or a mixture of the hard coking bituminous coal mine bank waste may alternatively be made with anthracite spoil bank shale or other similar low grade fuels containing a small quantity of volatile matter, say a minimum of 4 per cent. Then if equal proportions of these are ground up and fired the average volatile matter content will not exceed 16½ per cent. Briquetting and carbonization of mixtures of bituminous with anthracite low grade fuels may be recommended in cases where the cement plant has a big boiler plant from which much steam is required, from 5 to 10 per cent of a pitch binding agent being as a rule quite ample, and a temperature ranging from 600 to 900 deg. C. being satisfactory for getting rid of unwanted volatile matter and leaving a more or less coky fuel in the retorts.

Non-Caking Bituminous Coal Slack of Long Flame Class

I described in the August issue the employment of caking bituminous coal mine culm of the long flame class as a fuel for cement producers. In many districts, however, buyers will find it an easy matter to obtain non-caking bituminous coal slack of the long flame class, and this should be used, provided that it is deliverable in a dry state. In many instances it is not worth while expending capital on getting rid of a large amount of moisture which it contains when freshly obtained from the dumps.

A glance at its analysis shows very clearly what should be purchased and what should not be purchased at any price, and assuming that the low grade fuel has been thoroughly but carefully dried before delivery, the following constants should be specially borne in mind.

As regards the fixed carbon content, this may be as much as 60 per cent, or as little as 50 per cent. A smaller quantity than the latter constant as a rule indicates that much rubbish is present, and the bituminous coal slack should, therefore, be rejected. The total carbon content varies between the same limits, starting, however, with a minimum of 70 per cent and a maximum of 80 per cent. Although there is a difference of 30 per cent between the minimum of fixed carbon and the maximum of total carbon, taking the lowest and best samples in turn, this is due very largely to the carbonaceous character of the volatile matter.

As regards hydrogen, it is useful to note that these low grade non-caking bituminous coal slacks contain from 4 to 5.5 per cent, but occasionally parcels are offered which contain much more, and these should be viewed with suspicion rather than with approval, as some of the hydrogen may be present in the form of water.

The volatile matter content is of immense importance, and cement firms should take a special note of it. In really good samples as much as 42.5 per cent of volatile matter may be yielded when the non-caking bituminous slack is heated at a temperature of 900 deg. C. in closed vessels, while many samples contain round about 38 or 39 per cent. Good as it may sound, this quantity of volatile matter is not of substantial value for cement firing purposes. It is, therefore, highly advisable to dilute this fuel with one containing a small amount of volatiles, and if one part of non-caking bituminous coal slack is mixed with two parts of anthracite spoil bank shale containing 4 per cent of volatile matter (calculating parts by weight), the average volatile matter of the mixture is reduced to 15.5 per cent. The ash content should be carefully watched, as it is very variable; but the calorific value where the fixed carbon and total carbon contents are high is excellent.

The modus operandi is comparatively simple, and consists of sorting this refuse, to reduce its ash content as completely as possible, mixing it with fuels containing little volatile matter, as above indicated, and then either carbonizing the combination alone, or carbonizing it after it has been briquetted with a small amount of water gas pitch, coal tar, or wood pitch. If the briquettes are to be used for direct firing, they must be ground up and fired with powdered coke or coal.

Non-Caking Lignite Culm

Many references have been made at various times to the use of lignite as a fuel for cement burning. As regards the non-caking lignite culm, which is available often in big quantities, a few additional particulars may be furnished now, as I doubt very much whether cement trade executives will have grasped their significance.

The first and most important point of all is that no non-caking lignite culm should be purchased unless it is dried before delivery. Those who are as fully familiar with it as I am will need no explanation as to the wisdom of this, but those who do not handle big quantities constantly will be amazed when they hear that it sometimes contains nearly 50 per cent of moisture in a fresh state. Assuming that it has been carefully dried, and its bulk and weight diminished accordingly, operators should aim at purchasing those parcels which show a minimum of 50 per cent of fixed carbon, the maximum being as a rule 55 per cent. In this instance the total carbon content varies between far wider limits. The minimum should be 55 per cent, while the maximum will probably be as much as 75 per cent in very good samples.

Cement men need not take particular notice of the hydrogen content, as this is not subject to big variation, being round about 5 per cent in many samples. The volatile matter content estimated, however, at varying temperatures should be most carefully watched, as it is of immense importance. Assuming that in this instance a test is taken at 900 deg. C., no less than 45 per cent may be detectable, and this high amount may prove embarrassing unless special steps are taken in the manipulation of the fuel to reduce it. The ash content also varies very considerably; sometimes parcels of non-caking lignite culm can be picked up containing as little as 5 per cent, but in many instances the amount of non-combustible matter is up to 15 per cent. The calorific value is naturally very variable.

As regards the modus operandi, first of all take a moisture test, in order to ascertain that water has been completely got rid of. Then take a volatile matter test at 900 deg. C., and if this is down to one-third of the above constant, as it may be, samples should be rejected, as much volatile matter will have been driven off by careless drying at the point of production. Every consignment should also be carefully tested for ash, and no effort should be made to reduce its content in this direction if more than 15 per cent is revealed, as it will not pay to do so. In this instance it is best to decline the sample altogether. Assuming that you have been able to obtain a satisfactory consignment with 5 per cent of ash, 45 per cent of volatile matter, and 75 per cent of total carbon, this quantity including, of course, the carbon of the volatile matter, the best thing to do is to mix it with anthracite spoil bank shale or anthracitic steam coal slack containing round about 5 per cent of volatile matter. Take in the first instance equal weights of the two, in order to reduce the total volatile matter to 25 per cent. A second mixture may be made with advantage containing two parts by weight of anthracitic or anthracite residues to one of lignite culm, thereby reducing the average volatile matter content of the combination to 16⅓ per cent. This can be ground up and fired along with powdered coke or ground coal ordinarily used in the cement mill, but even better results will be obtained by packing it tightly into capacious metallic retorts with or without the aid of a small quantity of water gas pitch, and carbonizing the whole consignment as completely as possible in the absence of air. This coke is then lightly quenched, avoiding excess of water, and ground up with coke made from high grade coal, taking about equal quantities of each.

Semi-Bituminous Non-Caking Coal Slack of Short Flame Class

Cement producers are certain to be able to obtain many different types of semi-bituminous non-caking coal slacks. They should devote more attention than they ordinarily do to those of the short flame class. These slacks are often very wet, and should only be purchased if they have been dried before delivery. Assuming that this has been done, specify for a minimum fixed carbon content of 75 per cent, while the higher this is the better. As a rule it will never get above 85 per cent. The total carbon content is rather more in good usable samples, and cement factory owners should specify that not less than 88 per cent shall be present, while it will as a rule be difficult for them to get higher than 92 per cent in this connection. A low hydrogen content is desirable, rather than a high one, the minimum being as a rule 3.5 per cent, and the maximum desirable constant being 4.5 per cent. Volatile matter should be estimated at 900 deg. C., and this varies between wide limits according to the actual character of the coal. Some samples show only 10 per cent, while others show up to 20 per cent. The ash content as a rule is small, while the calorific value, if well dried at a low temperature, but not rapidly dried (which results in getting rid of some of the volatile matter), is as a rule good.

Cement firms will find that they get the best results if they aim at purchasing this type of fuel showing 10 per cent of volatile matter at 900 deg. C., as then it is hardly necessary to mix it with anthracite or anthracitic residues in order to reduce this. They should also aim as far as possible at getting those parcels which contain 92 per cent of total carbon, as again it is then unnecessary to mix the material with other low grade fuels in order to raise the total carbon content still higher. Carbonization is not essential in the case of fuels of this character, but it is often desirable, as then the semi-bituminous coke can be ground up with coke made from the best coals more easily and in a more satisfactory manner than can the slack itself. Passage along an endless band arrangement is sometimes desirable, in order to examine the slack, while frequently it is additionally desirable to treat the material on a band screen, so as to separate the fine stuff from the coarse. Analyses of each should, however, be made, as in some instances the dust is of higher calorific value, and contains more total carbon than the coarse stuff. Briquettes can be made of this material with a very small quantity of binding agent, and these can be used for boiler firing, while the carbonized bricks grind well if this step is resorted to, and the powdered fuel gives a hot flame for actual cement burning.

Five Per Cent Differential Ruling Made on Colorado Cement

Cement produced in Colorado must be given a 5 per cent differential in price for city paving work, the Denver city attorney ruled recently. If other cement is offered more than 5 per cent cheaper, it may be used, according to the ruling made after the legality of the use of Wyoming cement was questioned.

During the previous city administration, contractors were informed that only the Colorado product was acceptable.

It was recently also pointed out that the state law does not compel the use of the Colorado product when it fails to meet the conditions imposed by the city charter, and that the manager of improvements may buy cement direct and ask for labor bids only.

San Jose Plant Survey Starts; Construction in November

Surveying of the site of the proposed $2,250,000 plant of the San Jose Cement Co., Ltd., near San Jose, Calif., was scheduled to begin early in August, to be followed by actual construction about November 1.

The wet process will be used, with gas as fuel.

Central Agency Takes Over Sales of Iwaki Company

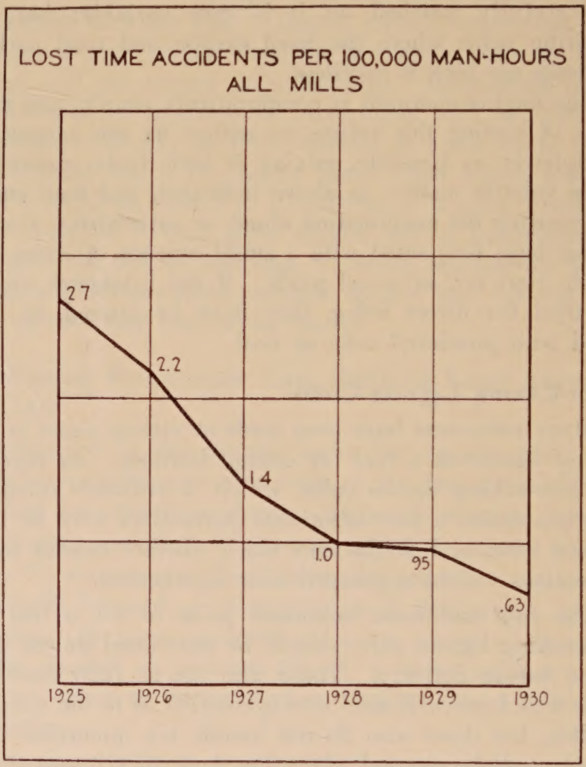
In addition to their agency to handle the sales of the Iwaki Portland Cement Company, Mitsubishi Shoji Kaisha has recently taken over the agency for the Hokkoku Portland Cement Company. The contract was signed May 26. Annual sales will amount to approximately 28,300 tons.

This arrangement places control of the Japanese cement industry in the hands of the three large trading companies, as Mitsui Bussan Kaisha is the agent for the Onoda and Oita Cement Companies. Asano Bussan Kaisha operate their own plants and have close connections with the Nippon Cement Company.

1930 Final Accident Statistics Show Improvement

Complete statistics on 1930 accidents show great improvement over the preceding year from several angles, according to the Accident Prevention Bureau of the Portland Cement Association.

The total of lost-time and fatal accidents in the mills reporting to the association was reduced from 723 in 1929 to 438 in 1930, a reduction of 40.8 per cent. Fatalities were reduced more than half, from 37 to 18. Permanent disabilities were only 48 in 1930 as compared to 54 in 1929, four of which were total. There were no permanent total disabilities in 1930.



Only 128 mills reported statistics last year, a drop of ten from 1929. Had the same number reported, the number of accidents would likely have been about 10 per cent higher, but the frequency and severity rates would not have been changed substantially.

Because of the decline in fatalities and permanent disabilities, the severity rate was reduced from 420.6 in 1929 to 246.6 in 1930.

Bessemer Recalls Men After Two-Month Shutdown

One hundred men returned to work at the Bessemer Limestone & Cement Company's plant at Bessemer, Pa., early in August, after two months' idleness.

Further recalling of employes is likely if demand for the company's product is maintained.

EDITORIAL

Undeveloped Markets

EDWARD J. MEHREN takes office as full-time president of the Portland Cement Association on the first day of this month.

It can be said without reservation that in the period since the announcement of his election the cement industry has experienced a distinct improvement in sentiment. The feeling exists that while the difficulties within the industry can not be eliminated in a week or a month, a way will now be found to eliminate them.

The further feeling exists that the members of the committee appointed to select a new leader displayed exceedingly good judgment when they made their selection outside the industry. They obtained a leader who, aside from his ability and personality, can look at the problems of the cement industry from the detached viewpoint of the outsider, uninfluenced by past traditions.

It may be said, too, that detached observers have seen many interesting things happening in the cement industry during its development through the past 25 years.

First of all, there was the organization and growth of the Portland Cement Association itself, with many commendable achievements to its credit, operated by a personnel that won respect and confidence.

In other respects it seemed that the association in particular, and the cement industry as a whole, profited from out-and-out good luck.

For example, the association was lucky in the fact that a concrete road champion with the faith and enthusiasm of Edward N. Hines built what were, in the final analysis, experimental concrete roads.

The association was lucky in the fact that many other public officials, after looking over the roads that Hines had built, were ready to spend public funds for building roads and pavements of a type that did not then have the test of time behind it.

Again the association and the cement industry as a whole were extremely lucky when Clifford Older, then chief engineer of the Illinois state highway department, conceived and built the Bates road test project, in which the serviceability of concrete as a highway construction material was demonstrated under actual service conditions before the highway engineers of the world.

In the cases just cited the Portland Cement Association observed the work that was done and disseminated the information that was developed. It was unfortunate, and hardly to the credit of the association, that a very practical demonstration such as the Bates road test had to be financed and built by a state highway department. The information gained from those tests could have been made available to highway engineers many years earlier if the association had taken the matter in hand when concrete roads first became an important factor in highway construction.

Today many great problems remain unsolved, which need large-scale tests comparable to the Bates road tests for their solution. Will the association continue to confine itself to laboratory research and the dissemination of information developed by others, or will it embark upon a program of structural field research designed for the development of specific markets, many of them of vast proportions?

Consider, for instance, the possibilities in the field of reinforced concrete roadbeds for railway tracks. If this development is left entirely to the railways, the life span of a generation will pass before the work started by the Pere Marquette Railway can reach its full development. What is needed here is the construction of test roadbeds of various types, then their subjection to the continuous pounding of railway traffic to the point of destruction. In this way the flaws in the various types can be detected and the best types can be determined.

With 250,000 miles of steam railway tracks and nearly 50,000 miles of city and interurban electric railway tracks in the United States alone, here is a potential market for 900 million barrels of cement awaiting development.

Likewise, as pointed out in an editorial on this page in the June issue, the cement industry would benefit immensely from the full development of the possibilities of light-weight aggregates. Several light aggregates are already on the market. Others are in the process of development. With one or two exceptions, lack of capital is probably the chief obstacle to their growth.

Either through the formation of a manufacturing subsidiary, or through some other legal means, the cement industry should take over or assist in the development of low-cost light-weight aggregates that have merit. These aggregates will aid the use of cement wherever weight is a cost factor, as it is in every structure of substantial size. An almost unlimited market lies here, awaiting development.

The full development of the light aggregate market will be accomplished only after years of painful progress if the responsibility is left entirely on the shoulders of that young industry. The same is true of many other potential markets.

Laboratory research and the dissemination of information developed by others constitute important activities that must be continued; but these activities should now be subordinated to the greater duty of uncovering the vast undeveloped and under-developed markets for cement. The cases here considered are only a few of the many possibilities.

West Penn's Mining and Crushing Methods and Costs

Loading and Transportation—Production and Efficiency of Shovels—Crushing Plant Operating Data—Third of Output Sold as Commercial Crushed Stone

By GEORGE A. MORRISON[1]

THE August issue contained a description of the geology, the methods of exploration and sampling, the mining methods, and drilling and blasting practice at the limestone mine of the West Penn Cement Company.

In this issue the loading and transportation methods and the crushing plant will be described, together with such matters as drainage, ventilation and timbering.

Loading the Stone

The broken stone is loaded by means of three full-revolving electric shovels which are mounted on caterpillars. These shovels are of ⅝, 1, and 1¼ cu. yd. capacity, respectively. The ⅝-cu. yd. shovel is several years old and inefficient, but the other two are of modern design and have proved very efficient. Each of these newer machines is fitted with a 15-ft. boom and a 10-ft. dipper stick. The first two shovels use 250-volt current supplied from the trolley lines, and the last and largest uses alternating current at 440 volts, which is converted to 250 volts (d. c.) by means of a motor generator set mounted on the shovel.

Shovel Power

An alternating current of 2,300 volts is brought into the mine through a 12-in. drill hole 140 ft. deep. This current is stepped down at the bottom of the hole to 440 volts before being carried in well-insulated triple-conductor cable through the mine to suitable taps for connecting flexible feed wires to the shovel. The largest shovel has proved especially satisfactory and has repeatedly loaded more than 1,000 tons of stone in a 10-hour shift. In 1930 it averaged 700 tons per shift. An average for the three shovels combined is 1,500 tons per shift. The shovels clean up well along the ribs and at the faces. Each is served by a trolley locomotive equipped with a gathering reel and running on double track in each entry and room. These locomotives keep an empty car at the shovel on one track while replacing a loaded car with an empty one on the other track. Enough empty cars are kept in the string at the shovels so that more than one car can be loaded before requiring replacement with empties. When a train of 7 to 12 cars has been loaded, it is hauled away to the crusher and an empty train is moved up to the shovel. In the meantime the shovel has from 2 to 4 empty cars to load which were left by the locomotive before making its trip.

Table 1 shows the loading data for the first six months of 1930.

Hand Loading

Hand loaders are employed at a contract price of $0.215 per ton to clean up faces and clean out rooms where track is to be laid up to the blasted pile, so the power shovels can work on a thick pile of broken stone. At present the hand-loaded tonnage amounts to about 17 per cent of the total tonnage. Later another power shovel will be put to work and much of this hand labor will be eliminated.

A typical shovel crew consists of the following men:

Drillers	2 — 4
Drillers' helpers	2 — 4
Scalers and blasters	2 — 3
Locomotive runners	1 — 2
Locomotive-runners' helpers	1 — 2
Trackmen	2 — 4
Shovel runners	1 — 1
Shovel-runners' helpers	1 — 1
Total	12 —21

Transportation

Seven-ton trolley locomotives are used, and at present there are four on the property. One locomotive is used for each shovel, and the fourth is used to haul to the crusher from a remote part of the mine. At present the locomotives gathering for two of the shovels also haul to the crusher.

These locomotives have 22-in. wheels with a 4-in. face, a 44-in. wheel base, and are 13 ft. long over-all. They are powered with two 120-ampere, 250-volt motors, are driven by worm-gears, and have a draw-bar pull of 3,700 lb. Previously horses were used for gathering, but in 1930 their use was entirely discontinued.

The mine cars are a solid-body type dumped by means of a rotary car-dumper, which is actuated by compressed air. These 135-cu. ft. capacity cars have 4-in. axles, with outside journal boxes mounted on 8-in. Hyatt roller bearings and are equipped with four-wheel brakes. The car is 12 ft. long by 6 ft. wide and stands 46 in. above the track. The wheels are 16-in. chilled iron, having a face of 4 in. and a wheel base of 38 in. One wheel is tight on each axle. The car bottom is of 3-in. oak plank between ⅜-in. sheet-iron plates. The cars weigh nearly 4 tons each and carry an average load of 8 tons. The couplings are swivel-hitchings of heavy design, so a train

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Reprinted from U. S. Bureau of Mines Information Circular 6446.

[1] One of the consulting engineers, U. S. Bureau of Mines.

TABLE 1

Power Shovel Data, January 1st to July 1st, 1930

Shovel number	No. 1		No. 2		No. 3		Totals and averages	
Total tons loaded	61,000.		72,500.		26,700.		160,200.	
Tons loaded daily (10 hrs.)	555.		702.		342.		550.	
Tons loaded per car	7.75		7.73		8.15		7.80	
Percentage of time operating	84.		85.		74.		83.	
Percentage of lost time	16.		15.		26.		17.	
Loading cost in dollars per ton:								
Operating labor	0.028		0.028		0.047		0.037	
Repair labor	.005		.006		.014		.007	
Operating supplies	.002		......		......		.001	
Repair supplies	.008		.007		.015		.008	
Power	.004		.003		.006		.004	
Total cost	.048		.044		.082		.052	
Operating data:	Per cent	Minutes per shift	Per cent	Minutes per shift	Per cent	Minutes per shift	Per cent	Minutes per shift
Delays due to—								
Mechanical trouble	11	25	20	24	30	59	19	31
Electrical trouble	15		7		8		10	
Moving shovel	11	11	20	18	16	25	17	17
Track-laying, etc.	26	60	20	48	9	72	21	54
No empties	12		16		20		15	
Locomotives	5		4		2		4	
Wrecks	12		8		10		10	
Bench (hard digging)	8		1		5		4	
Total delays	100	96	100	90	100	156	100	102
Maximum hourly production (tons)	75.		105.		45.		79.	
Average hourly production (tons)	55.5		70.2		34.2		55.0	
Efficiency: Average divided by maximum (per cent)	74½		67.		76.		70.	

Note: All shovels are electric, full-revolving and served in the same manner. No. 1 shovel is of 1 cu. yd. dipper capacity. No. 2 shovel is of 1¼ cu. yd. dipper capacity. No. 3 shovel is of ⅝ cu. yd. digger capacity.

can be dumped at the crusher without uncoupling the cars. Table 2 shows transportation data for the first 6 months of 1930.

Trains of from 8 to 12 cars traverse a circuit so arranged that they are always moving in one direction.

Tracks of 36-in. gauge are laid with 40-lb. rails on 5 by 6 in. by 5-ft. oak ties on 2½-ft. centers. Every fourth tie is a steel one of heavy design having fixed gauge clamps. Curves are of 70-ft. radius. No. 3 frogs are used in the switches with 5-ft. switch points and 7 to 9 ft. lead rails. The floors are usually smooth and level but occasional rolls occur.

Service tracks to the working faces are of a temporary nature and are made up of 10, 15, 20 and 30-ft. sections mounted on light steel ties so they can be removed and carried to another working face or else relaid when required after blasting. Rock ballast is used on all permanent track, and every effort is made to maintain all such track in the best condition.

Parallel throw-switch stands are used to avoid the possibility of the operator being thrown under passing cars when throwing a switch.

In 1930 the average haul (loaded) was about ¾ of a mile and the 75 cars serving the shovels averaged five trips per shift.

Car repairs at present are mostly due to broken wheels. A new wheel has been designed and its use is expected to reduce this breakage greatly.

The trolley is a "0000" wire suspended 8½ ft. above the track by means of "low-mine" suspension insulators and pipe trusses fastened into the roof by expansion sleeves. By careful bonding and cross-bonding a current of 250 volts is maintained throughout the mine.

All power is purchased, at 2,300 volts, and transformed to 250 volts direct current for haulage in the mine by means of a 150-kilowatt motor-generator set of modern design which is in turn served by an automatic switchboard.

Ten to 12 men are engaged in serving the shovels and maintaining track.

Drainage

Little water is encountered, but in certain sections of the mine there is some water at the faces and it is a great hindrance in laying track and in screening the wet stone in the crushing plant. Small pumps operated by air are installed where necessary and moved from place to place as required.

Ventilation

All ventilation is natural and is obtained by frequent openings to the surface. These openings are of a large cross-section. The constant clearing away of all rubbish and the confining of blasting to one shift contribute to maintaining excellent working conditions.

Timbering

Occasional timbering is required to support certain layers in the roof that may become loose. Ten to 12-in. posts cut from the company's property are used with heavy headboards. At some places in the mine the openings to the surface pierce roof layers so badly leached that they have no strength. In such places drift sets with heavy lagging are required.

Shale Mining

The floor of the limestone is shale, which extends from about 14 ft. to a 42-in. bed of coal. This shale is mined out of rooms from which the stone has been extracted.

To reach this level at the top of the coal a track on a 7-deg. slope is carried down from the old room floor at one place in the mine. The track is thereafter continued on the top of the coal from room to room, going through ribs as they are encountered at points where holes have previously been cut in mining the limestone.

The shale is broken with sinker drills which drill 12-ft. holes on 6-ft. centers in the old room floors. About 250 tons of shale are required per day and this is broken by two men who do all drilling and blasting and look after the track. The shale loading is all done by hand. The loaders are paid on contract at a rate of $0.215 per ton.

The coal uncovered by mining the shale is left in place

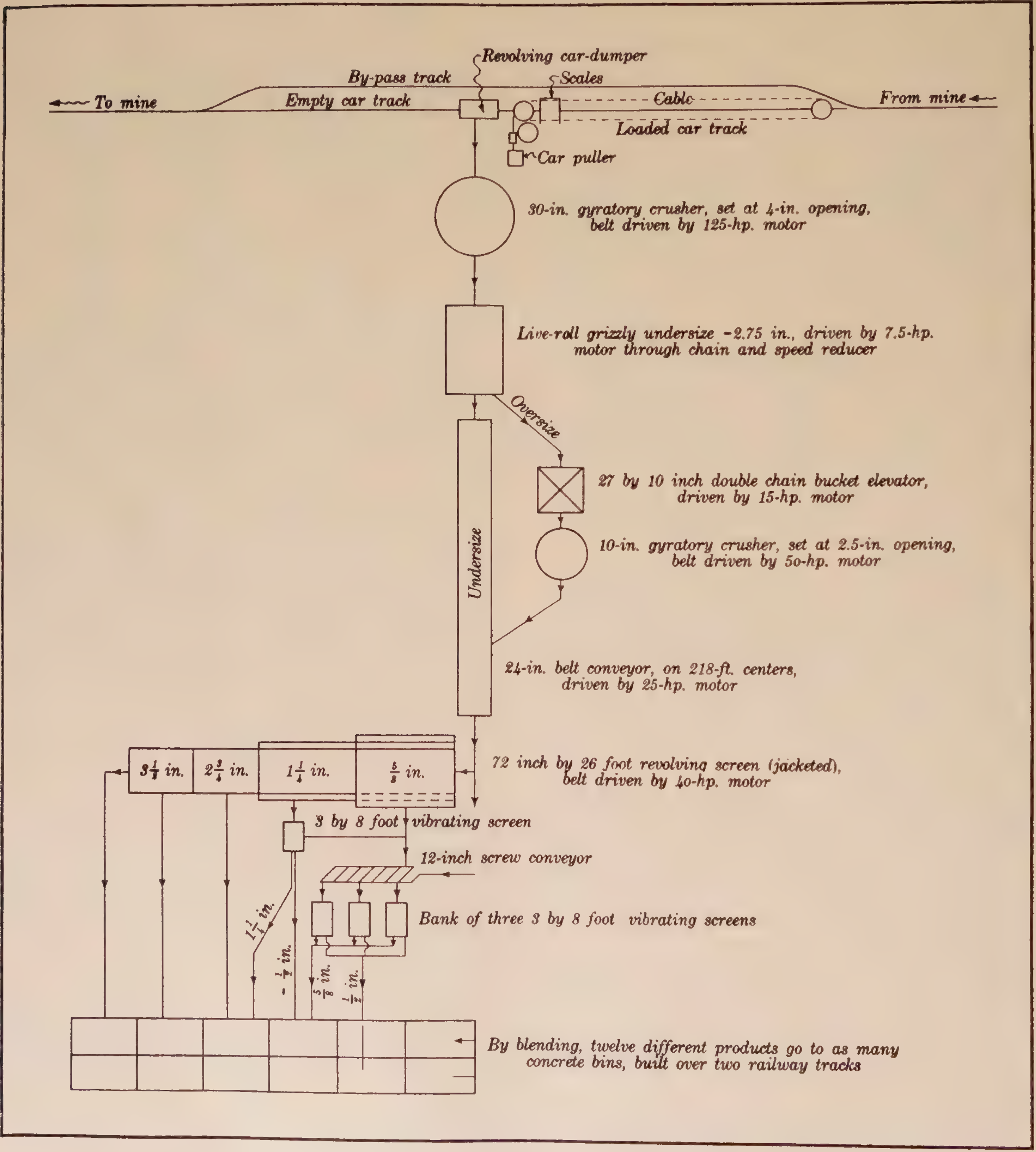

Revolving car-dumper
By-pass track
Scales
To mine
Empty car track
Cable
From mine
Loaded car track
Car puller
30-in. gyratory crusher, set at 4-in. opening, belt driven by 125-hp. motor
Live-roll grizzly undersize -2.75 in., driven by 7.5-hp. motor through chain and speed reducer
Oversize
Undersize
27 by 10 inch double chain bucket elevator, driven by 15-hp. motor
10-in. gyratory crusher, set at 2.5-in. opening, belt driven by 50-hp. motor
24-in. belt conveyor, on 218-ft. centers, driven by 25-hp. motor
3½ in.
2¾ in.
1¼ in.
⅝ in.
72 inch by 26 foot revolving screen (jacketed), belt driven by 40-hp. motor
3 by 8 foot vibrating screen
12-inch screw conveyor
Bank of three 3 by 8 foot vibrating screens
1¼ in.
-½ in.
⅝ in.
½ in.
By blending, twelve different products go to as many concrete bins, built over two railway tracks

Figure 4. Flow sheet of West Penn's crushing plant

for mining at some future date when it may be required. A considerable tonnage of this coal has already been uncovered.

Crushing Plant

Car-Dumper. The loaded cars, delivered by locomotives in trains of from 8 to 12, are set on the loaded-car track at the crushing plant. An electrically driven car-puller, consisting of a standard hoist handling a continuous cable through sheaves along this track, hauls the trains in over the car scales and into the car dumper, which is set on a 1½ per cent slope. The cars are completely emptied without being uncoupled by being given a half turn in the dumper cradle, which is revolved by means of compressed air. Two men serve the dumper and also hook the trains and look after the crushers below. The empty cars drift down the empty-car track to be picked up by the locomotive that brought in the loads and which has by-passed the crusher building. The return trip into the mine is on a different track than that over which the loads came out and a circular path of traffic is thereby maintained over which the trains are moving only in one direction.

The dumped stone goes directly into a 30-in. gyratory crusher with its discharge opening set at 4 in. and which is belt-driven by a 125-hp. motor. The product from this primary crusher goes over a No. 9 live-roll grizzly with 2¾-in. openings which is powered by a 10-hp. motor driving through sprockets and chain.

From the grizzly the oversize is lifted by means of a 40-ft. elevator equipped with close-connected steel buckets on double chains, to a 10-in. gyratory crusher which is set at a 2-in. discharge opening and is belt-driven by a 40-hp. motor. The discharge from the crusher joins the undersize from the grizzly and is delivered onto a 24-in. conveyor belt 218 ft. long and inclined 3⅛ in. per ft. which conveys the stone to the top of the screen room.

In the screen room is a double-jacketed revolving screen

TABLE 2

Transportation Data, January 1st to July 1st, 1930

Tons hauled, stone and shale	212,116
Tons hauled, stone and shale (including double haul in gathering	292,100
Average length of haul, feet (loaded)	2,359
Ton-miles hauled	130,500

Costs (gathering included)

	Per cent	Per ton produced	Per ton double-hauled	Per ton-mile
Locomotives:				
Operating labor		0.027	0.0196	0.0438
Repair labor		.004	.0038	.0062
Operating supplies		.001	.0007	.0015
Repair supplies		.003	.0025	.0055
Power		.003	.0021	.0047
Total locomotives	34	.038	.0287	.0617
Trolley:				
Labor		.004	.0032	.0071
Supplies		.002	.0016	.0035
Total trolley	5	.006	.0048	.0106
Cars:				
Labor		.005	.0038	.0085
Supplies		.006	.0041	.0092
Total cars	10	.011	.0079	.0177
Track:				
Labor		.038	.0275	.0609
Supplies		.015	.0111	.0247
Total track	48	.053	.0386	.0856
Livestock:				
Labor and supplies	3	.004	.0032	.0068
Total transportation	100	.112	.0832	.1824

Note: The average tons per trip to the crusher is 64. Gathering requires many trips of but small tonnage; making up trains and placing empties. The average carload is 8 tons.

TABLE 3

Crushing Plant Operating Data, First Eight Months of 1930

Month	Tons	Total hours	Delays in hours due to: No stone	No railroad cars	Big pieces	Miscellaneous	Total
January	33,800	195	16	1	3.5	3	23.5
February	26,400	144	15	.5	1	4	20.5
March	37,000	200	24	1.5	3	6	34.5
April	23,650	152	32.5	----	3.5	.5	36.5
May	42,500	250	30.5	----	5	2	37.5
June	51,700	270	25	----	3	3	31
July	48,200	231	32	1	4	5	42
August	51,975	262	40	----	6.5	1.5	48
Total	315,225	1,704	215	4	29.5	25	273.5
Percentage of delays	----	----	78.5	1.5	11	9	100
Percentage of lost time							16
Average number of tons per hour							186
Average number of tons per hour (if no lost time)							220

Note:

"No stone" means that the dumper was idle because of no loaded mine cars to dump.
"No railroad cars" means that there was a shortage of these cars.
"Big pieces" indicates that the crusher was plugged or arched over.
Under "Miscellaneous" are included delays for oiling, repairs, or cars with broken wheels.
The tonnage is for stone and shale. The shale is much slower in crushing.
The plant capacity can be assumed to be 250 tons per hour, and the actual production 225 tons.

72 in. in diameter and 26 ft. long, mounted at a slope of 1¼ in. to the foot, over concrete bins. The holes in the revolving screen are round and are punched in ⅜-in. plate. The first jacket is also made of punched plate but the second one is of woven wire with ⅝-in. holes. All vibrator screens are also of wire screening with square holes. The products of the revolving screen, after the proper blending on vibrating screens, fall into 12 concrete bins which hold about 150 tons each. The bins feed through wide-mouthed gates, operated by hand, into railway cars standing on the double railway tracks immediately beneath.

The delivery of the product carried by the conveyor from the crushers is arranged so that, by means of chutes and gates, stone for the cement plant can be delivered directly to bins without having to go through the revolving screen. The screened products are blended as required by the specifications of the trade for road material and concrete aggregate.

An 18-in. apron conveyor traverses one side of the bins and elevates material from any bin to a mechanically-vibrated screen which is drenched with water from numerous nozzles under high pressure. This washed material is drained while passing through metal spouts into the railway cars below.

Finished stone for the cement plant is delivered in hopper-bottomed railroad cars which are drawn into the unloading tunnels at the plant, or else have their loads stocked in convenient piles to be reclaimed by locomotive cranes as required.

Truck haulage from all bins is provided by conveniently operated chutes. Figure 4 is a flow sheet of the plant.

Table 3 gives a summary of crushing data for the first eight months of 1930.

In the three years this plant has operated, no renewals have been required by the crushers (except for some bottom plates in the 30-in. gyratory), conveyor, or revolving screen. Chutes have had to be relined and patched, however. The screens on the vibrators last about six months, and the drive belts on them are likely to whip out at the fastenings in a few months.

The flow sheet (Figure 4) shows that the undersize through the ⅝-in. revolving screen passes to a bank of three vibrating screens. A smaller number of vibrators might do the work, but it was considered possible that ⅛-in. screens might be used on them, and as the stone

TABLE 4

Screen Analyses

	Primary crusher				Secondary crusher				Main screen		⅝-inch screen	
	Mine run (feed)		Product		Feed		Product		Feed		Feed	
Percentage of total	100		100		35.75		35.75		100		17	
Tons per hour	225		225		80.50		80.50		225		38.25	
	Per cent	Tons	Per cent	Tons	Per cent	Tons	Per cent	Tons	Per cent	Tons	Per cent	Tons
Plus 6-inch	25	56.25	0	------	------	------	------	------	------	------	------	------
Minus 6 plus 3½-inch	15	33.75	*6	13.50	*71.5	57.56	*5.8	4.67	2.0	4.50	------	------
Minus 3½ plus 2¾-inch	19	42.75	32	72.0	17.5	14.09	*33.0	26.57	12.0	27.0	------	------
Minus 2¾ plus 2-inch	12	27.00	14.8	33.3	8.5	6.84	32.1	25.84	25.0	56.25	------	------
Minus 2 plus 1¼-inch	10	22.50	18.0	40.50	1.5	1.21	21.5	17.30	26.0	58.50	------	------
Minus 1¼ plus ⅝-inch	10	22.50	†15.0	33.75	.5	.40	3.8	3.06	18.0	40.50	------	------
Minus ⅝ plus ⅜-inch	2	4.50	3.0	6.75	------	------	1.0	.80	4.0	9.00	21.2	8.10
Minus ⅜ plus ⅛-inch	3	6.75	†5.6	12.60	.25	.20	1.4	1.13	6.5	14.625	38.8	14.85
Minus ⅛-inch	4	9.00	†5.6	12.60	.25	.20	1.4	1.13	6.5	14.625	†40.0	15.30
	100	225	100	225	100	80.5	100	80.5	100	225	100	38.25

*Mostly flat tabular pieces.

†Increase in percentage due mostly to spalling and wearing down in chutes.

TABLE 5

Screen Analyses of Various Crushing-Plant Products

Percentage through

Material	100 mesh	⅛ inch	¼ inch	⅜ inch	⅝ inch	1 inch	1¼ inch	1½ inch	2 inch	2½ inch	2¾ inch	3½ inch	4 inch
A	10-25	------	------	------	100	------	------	------	------	------	------	------	------
B	------	0.10	0-20	------	100	------	------	------	------	------	------	------	------
C	------	------	------	0-8	10-40	------	95-100	100	------	------	------	------	------
D	------	------	------	0-10	0-50	95-100	100	------	------	------	------	------	------
E	------	------	------	0-8	5-20	------	30-65	------	------	95-100	100	------	------
F	------	------	------	------	------	------	0-15	------	30-65	95-100	100	------	------
G	------	------	------	------	------	------	0-10	------	------	25-50	------	90-100	100
H	------	------	------	0-8	0-30	------	95-100	100	------	------	------	------	------
I	------	------	------	0-8	0-15	------	30-65	------	------	95-100	100	------	------
J	------	------	------	------	------	------	0-15	------	------	30-65	------	95-100	100
K	------	0-3	0-10	25-40	Pass ½″	------	------	------	------	------	------	------	------
				25-40	Pass ¾″	25-40	90-100	100	------	------	------	------	------
L	------	------	------	0-8	0-15	------	30-65	------	------	95-100	100	------	------
M	8-12	------	------	------	95-100	------	------	------	------	------	------	------	------
N	------	------	0-5	------	0-25	------	------	75-95	100	------	------	------	------
O	------	------	------	0-8	0-15	------	30-65	------	95-100	100	------	------	------
P	------	------	95-100	100	------	------	------	------	------	------	------	------	------

Note: These products are not made at the same time, but the plant may be called upon at any time to make a number of them. They are made by blending in chutes and bins, so that the proper mixture goes into the railroad cars.

from the mine is often damp it is necessary to carry a thin bed on these machines to insure proper sizing.

Screen analyses of the various crushing plant products are shown in Table 4.

The crushing plant is operated primarily to supply the cement plant with raw material and the screening plant to supply surplus production to the commercial stone trade. The requirements as to size of commercial stone vary and the tonnage demand is also erratic. No anticipation of the sizes and tonnage required can be made definitely. Since space for stock piling is limited around the plant and the demand for the products fluctuates, it is often necessary to put the whole daily production over the screens to produce the required tonnage of some certain size or sizes.

Table 5 lists some of the products sold and their specifications. By means of spouting between screens and bins, mixtures are made so that many combinations can be turned out for shipment.

Per Cent Extraction

As there is no concentration, the crushing plant delivers the same tonnage it receives.

The mining recovery at present is 55 per cent. The remaining 45 per cent can be recovered later by removing pillars on a retreating system from any places where the surface is of so little value that subsidence is not objectionable.

The cement plant consumes two-thirds of the mine output and the balance is sold to the trade as commercial stone.

Bessemer Limestone Declares 50-Cent Quarterly Dividend

The Bessemer Limestone & Cement Co. declared a quarterly dividend of 50 cents on the Class A common stock, payable August 1 to stock of record July 20, placing the stock on a $2 annual basis, against $3 previously.

Monarch Employes' Benefit Club Gives Aid to Cement Plant Workers

Form and Management of Organization—Dues, Assessments, and Benefits Paid—How Claims Are Made and Verified—Examples of Benefits Derived

By W. J. SINCLAIR, Jr.
Monarch Cement Co., Humboldt, Kans.

THE Monarch Employes' Benefit Club, an organization of employes of the Monarch Cement Co., at Humboldt, Kans., was formed in 1924 for the purpose of helping members of the club over the rough places. Formation of the club brought system and regulation into this work of mutual aid, and brought to an end the unsatisfactory practice of volunteer efforts, with frequent papers being passed around for donations to help an employe who had met with misfortune.

Officers and Their Duties

The club organization may be visualized from the list of officers and committees and a statement of their duties.

First, there is the governing body, consisting of the manager, the secretary, and the treasurer. These three officers are elected for a term of one year, at the annual meeting of the club. This annual meeting is the only meeting of all members of the club during the year.

Next, there is the membership committee of three, appointed by the manager, whose duty is that of passing on applications for membership. This committee is expected to use its own judgment as to whether a prospective member will be an asset or a liability to the club.

Another committee, also appointed by the manager, has the duty of passing judgment on all claims for benefit.

The secretary collects the monthly dues of members, and miscellaneous receipts.

The treasurer takes over the funds collected by the secretary, and he handles the payment of claims. All claims must be approved by at least two of the three members of the committee on claims, and all checks must be signed by the manager, the secretary and the treasurer.

Most of the work of the officers and the committees is done before or after work hours; but in case of necessity club work may be done during work hours. All officers and committee members donate their services without pay, but the secretary is excused from paying dues.

The cement company, as such, has no hand in the club management, except in an advisory capacity.

The Membership, Dues and Assessments

The club started in 1924 with a membership of ten, but the number grew rapidly, and for several years the membership has been held around 130. While membership is not compulsory, all the wide-awake men and women in the company's employ take this means of helping themselves while they are helping others.

Dues are $1.00 per month, but special assessments may be levied whenever necessary to meet approved claims in excess of funds on hand.

On the other hand, in 1928 we refunded $5.00 to each member and collected no dues for one month, so that the net dues for that year were only $6.00. Frequently we find it possible to avoid collection of dues or assessments during the winter shut-down. This year no dues were collected in January, February or March. Only twice has it been necessary to levy special assessments.

A new member must pay an initial sum depending on the amount in the treasury at the time. Suppose, for illustration, that the membership is 130 and there is $520 in the treasury. The new member must pay an initial sum of $4.00 plus the regular monthly dues. Likewise, a member leaving the employ of the company is entitled to receive a corresponding sum.

How Claims Are Made

A member in good standing is entitled to a benefit in cases of illness or injury that required the attention of a physician. The claim for benefit is made out on a printed form and signed by the attending physician. The part of the printed form that is filled out by the claimant must contain information on—

(1) Nature of disability;
(2) When a physician was first consulted;
(3) Number of days confined indoors;
(4) Number of times visited by physician;
(5) Number of visits to office of physician.

The part of the blank that is filled out by the physician supplies information on—

(1) Date when patient was first treated;
(2) Nature of claimant's disability;
(3) Statement whether claimant's condition caused absence from his duties;
(4) Number of visits to patient's home, including dates;
(5) Number and dates of office calls from patient;
(6) Date when patient was able to resume duties;
(7) Number of days of total disability.

Nature and Amount of Claims Allowed

A member is not allowed a benefit for the first seven days, after which the allowance is $2.15 per day for accident or sickness, regardless of where the accident happened or the kind of sickness. However, no claimant is allowed to draw more than $100.00 in any one year. In case of death, the member's family is allowed $100.00, less any amount previously drawn by the claimant during that year.

Financial Reports Posted

The club is not incorporated and the officers are not bonded. The officers selected are men who can be trusted with funds. A financial statement of balance on hand and claims allowed during each month, and the approximate amount of claims pending, is posted every month on the mill bulletin board near the time clock. An attempt is made to keep a balance on hand of not less than $500.00.

Examples of Benefits Derived

The writer could fill many pages in telling of the benefits derived from membership in this club. A few examples must suffice. A young man, married and with three children, developed an infection in his leg from an unknown cause. He was paid $86.00 for the time he was off. In another instance a member took sick and a few days later he passed away. In three days his wife received $100.00, for he had drawn no previous benefit during that year.

Merger of Two Leading British Cement Groups Under Way

By A. C. BLACKALL

Details of the provisionally arranged purchase of the Allied Cement Manufacturers group by the Associated Portland Cement Manufacturers combine have just been communicated to the stockholders of the latter company. By this deal the "Red Triangle" chain will be absorbed by the "Blue Circle" chain of cement undertakings. Included in the assets to be acquired are the works and businesses of the following concerns: Allied Cement Manufacturers, Ltd., Ellesmere Port; Holborough Cement Co., Snodland; Greaves, Bull & Lakin, Sittingbourne; Dunstable Portland Cement Co., Dunstable; and British Standard Cement Co., Rainham.

The combined domestic trade deliveries of the two groups last year equalled 70 per cent of the entire domestic cement trade of the United Kingdom.

The total purchase consideration is £2,025,000 ($10,125,000), plus a sum for certain manufacturing stocks and the like, which the directors consider on these terms should prove of definite advantage to the combine. As five of the companies mentioned had an aggregate paid-up capital of £4,370,472 ($21,852,360), apart from borrowing powers, the price would seem a reasonable one, allowing for over-capitalization and duplication.

To finance the purchase the directors have decided to issue 500,000 £1 ordinary shares, and the ordinary shareholders are given the right to take up at par one new share for every six shares now held. These shares will rank for one-half of all dividends in respect of the current year. Arrangements have also been made to issue £150,000 ($750,000) of 5 per cent second debenture stock and £180,280 ($901,400) of 5½ per cent £1 preference shares. On the completion of the purchase a further £750,000 of 5 per cent second debentures will be issued. In view of the recent fine record of the Associated Portland Cement combine the new shares are expected to be readily subscribed to by the shareholders.

More Articles by Alton J. Blank

The October *Cement Mill Edition* of "Concrete" will contain an article on "The Rotary Kiln in Cement Manufacture," by Alton J. Blank, general superintendent and supervising chemist of the Compania de Cemento Portland, Puebla, Mexico.

In this article the author will discuss the relative merits of small and large kilns, as well as the influence of mechanical attachments and the personal element of kiln supervision. Fuel economy, kiln control, and a study of refractory linings, are other phases of the rotary kiln that will be discussed by this able writer.

In the November issue Mr. Blank will write about the major dust losses in the manufacture of cement in dry-process plants.

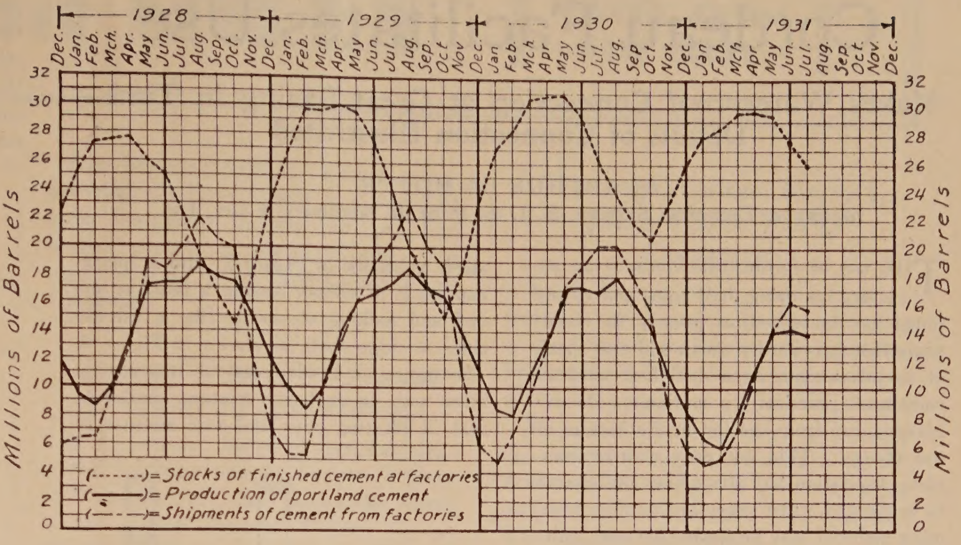
Cement Statistics for July

Slight Gains in Shipments Shown in Southeast and Northwest States

Relation of Production to Capacity

(Figures represent per cent)

	The Month	The Twelve Months
July, 1931	62.0	53.8
July, 1930	**77.8**	**66.1**
June, 1931	65.4	55.2
May, 1931	62.8	56.5
April, 1931	52.1	57.7



	1930	1931	Increase or Decrease, %
Production, July	**17,078,000**	13,899,000	—18.6
Shipments, July	**20,153,000**	15,545,000	—22.9
Stocks at end of month	**26,289,000**	25,957,000	—1.3

	1930	1931	Increase or Decrease, %
Total production for year	**92,972,000**	74,032,000	—25.6
Total shipments for year	**90,291,000**	73,964,000	—22.1
No. of plants reporting	**166**	165	—.6

Production, Shipments, and Stocks of Finished Portland Cement, by Districts, in July, 1930 and 1931, and Stocks in June, 1931

District	Production—July 1930	Production—July 1931	Shipments—July 1930	Shipments—July 1931	Stocks at end of month 1930	Stocks at end of month 1931	Stocks at end of June, 1931*
Eastern Pa., N. J. and Md.	**3,566,000**	2,675,000	**4,085,000**	3,114,000	5,992,000	**6,026,000**	6,465,000
New York and Maine	**1,249,000**	1,192,000	**1,524,000**	1,436,000	1,462,000	**1,670,000**	1,914,000
Ohio, Western Pa. and W. Va.	**1,973,000**	1,520,000	**2,358,000**	1,471,000	3,523,000	**3,559,000**	3,511,000
Michigan	**1,410,000**	983,000	**1,604,000**	1,147,000	**2,618,000**	2,208,000	2,372,000
Wis., Ill., Ind. and Ky.	**2,255,000**	1,877,000	**2,916,000**	2,275,000	**3,931,000**	3,518,000	3,915,000
Va., Tenn., Ala., Ga., Fla. and La.	1,213,000	**1,319,000**	**1,327,000**	1,210,000	**1,889,000**	1,588,000	1,479,000
Eastern Mo., Ia., Minn. and S. Dak.	**1,832,000**	1,414,000	**2,540,000**	1,896,000	2,495,000	**2,762,000**	3,244,000
W. Mo., Nebr., Kans., Okla. and Ark.	**1,405,000**	1,015,000	**1,442,000**	1,102,000	**1,688,000**	1,624,000	1,710,000
Texas	585,000	**646,000**	**709,000**	696,000	564,000	**626,000**	675,000
Colo., Mont., Utah, Wyo. and Idaho	217,000	**219,000**	**276,000**	229,000	501,000	**619,000**	629,000
California	**1,009,000**	670,000	**946,000**	624,000	1,144,000	**1,158,000**	1,113,000
Oregon and Washington	364,000	**369,000**	**426,000**	345,000	482,000	**599,000**	575,000
	17,078,000	13,899,000	**20,153,000**	15,545,000	**26,289,000**	25,957,000	27,602,000

Production, Shipments, and Stocks of Finished Portland Cement, by Months, in 1930 and 1931

Month	—Production— 1930	—Production— 1931	—Shipments— 1930	—Shipments— 1931	Stocks at end of month 1930	Stocks at end of month 1931
January	**8,498,000**	6,595,000	**4,955,000**	4,692,000	27,081,000	**27,759,000**
February	**8,162,000**	5,920,000	**7,012,000**	5,074,000	28,249,000	**28,612,000**
March	**11,225,000**	8,245,000	**8,826,000**	7,192,000	**30,648,000**	29,676,000
April	**13,521,000**	11,245,000	**13,340,000**	11,184,000	**30,867,000**	29,715,000
May	**17,249,000**	14,010,000	**17,224,000**	14,200,000	**30,891,000**	29,554,000
June	**17,239,000**	*14,118,000	**18,781,000**	*16,077,000	**29,364,000**	*27,602,000
July	**17,078,000**	13,899,000	**20,153,000**	15,545,000	**26,289,000**	25,957,000
August	17,821,000	....	20,299,000	....	23,824,000	....
September	16,124,000	....	18,083,000	....	21,889,000	....
October	14,410,000	....	15,599,000	....	20,697,000	....
November	11,098,000	....	8,784,000	....	23,056,000	....
December	8,480,000	....	5,688,000	....	*25,838,000	....
	160,905,000	....	158,744,000	....	....	....

Blacker type indicates larger of two figures.

*Revised.

New Device for Connecting Cordeau Facilitates Use

Makes Waterproof Connection at Great Saving in Time—Details of Connection Illustrated

By **ARTHUR LA MOTTE**
Manager, Technical Section, E. I. du Pont de Nemours & Co., Inc.

THE use of Cordeau-Bickford as an accessory for firing drill holes and coyote holes has increased so greatly in recent years that it is hardly worth while to speak of its advantages. In a drill hole cordeau constitutes practically a continuous electric blasting cap from the top to the bottom of the charge. This not only assures complete detonation but also allows the charge to be broken when necessary so that stemming material may be loaded between units of dynamite.

The usual method of firing drill blasts with cordeau is to use double-countered cordeau in the holes and plain cordeau as a main or trunk line on the surface. Heretofore, making connections has involved a considerable amount of rather delicate work. It has been necessary to slit the top of the down or branch line of cordeau for a distance of six or eight inches and then to wind the two halves in opposite directions around the trunk line as tightly as possible, as shown in Figure 1. Connecting a large number of holes in this manner takes time, especially if it is raining or snowing or sleeting, and the weather is no respecter of a blaster's comfort. On a cold day one's fingers become painfully cold in making these connections, and, moreover, if the T. N. T., which constitutes the filling of the lead tube of the cordeau, gets wet, the branch line is likely to fail.

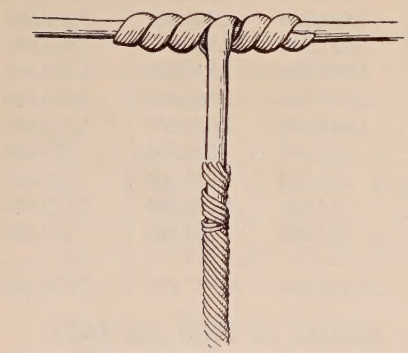


Figure 1. Method of connecting cordeau by slitting branch line and wrapping end around trunk line

To obviate these difficulties the Du Pont Company has developed a cordeau connector which does away with the slitting and wrapping of the down line around the trunk line. This cordeau connector consists of two parts: a clip made of spring steel, as shown in Figure 2; and a special cap made of copper having a bead at one end and looking somewhat like a rim-fire rifle cartridge shell, as shown in Figure 3. The upper or beaded end of this cap is filled with an explosive mixture similar to that in blasting caps and this mixture is held in place by an inner capsule having a minute central aperture, as shown in Figure 4. This inner capsule serves the double purpose of confining the charge and of preventing the lead tube of the cordeau from coming into contact with the explosive mixture.

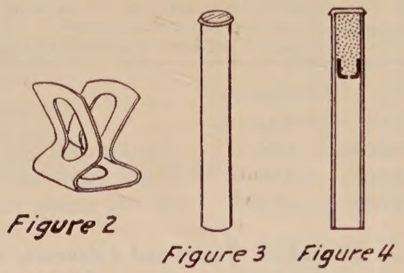


Figure 2. Clip of the new cordeau connector; Figure 3. Exterior view of the cap of the connector; Figure 4. Cross section view of the cap of the connector

To use this device, the copper cap is dropped through the aperture in the clip, as shown in Figure 5. The freshly cut end of the cordeau is then inserted in the lower open end of the cap until it touches the inner capsule and the cap is crimped fast to the cordeau, as shown in Figure 6. After a connector has been attached to the cordeau extending from each bore hole, as described, the trunk line is laid between the wings of the clips, one by one, and the clip is sprung open with the fingers, as shown in Figure 7. The cordeau drops into contact with the loaded end of the copper cap and is held firmly in place by the release of the clip, as shown in the complete assembly in Figure 8.

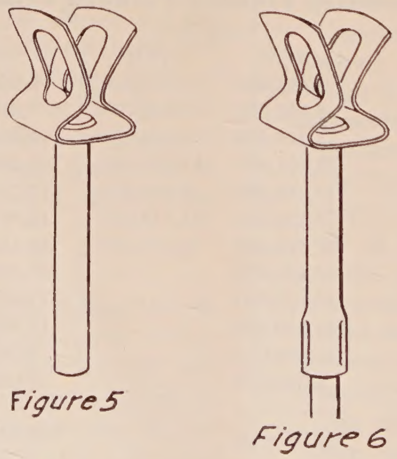


Figure 5. Cap in place in clip; Figure 6. The connector with cap crimped to cordeau

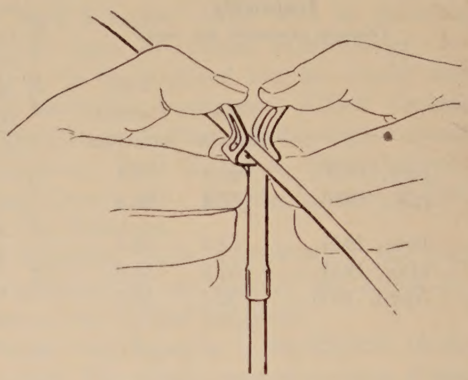


Figure 7. Springing the clip apart to allow cordeau to drop into place

The advantages of this device are several. First, it makes a waterproof connection; after the cap and clip have been crimped onto the down line of the cordeau, rain, snow and sleet cannot affect it. Second, the connection is made in a fraction of the time required by the former method. And third, the device is simple and easy to use and functions perfectly regardless of the weather. In a word, it aids the blaster, saves time and gives greater assurance of the detonation of all the down lines of cordeau by a trunk line.

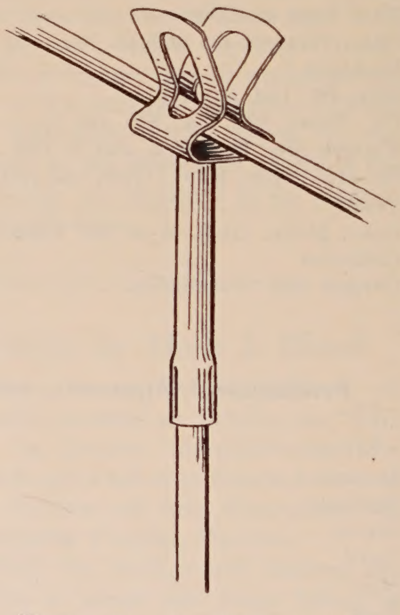


Figure 8. Complete assembly with cordeau held firmly in place by the clip

MEN and MILLS [NOTES FROM ✦ THE FIELD ✦]

Medusa Combines Safety Meeting with Entertainment

An open air safety meeting and entertainment was given for its employes by the Medusa Cement Company at Medusa Park at Dixon, Ill., on August 6.

C. B. Fowler, chief chemist, acting as chairman, introduced W. L. White, Jr., assistant general manager, of Cleveland, who talked briefly on the importance of safety in industry.

E. J. Maguire, vice-president of the company, following a short talk on safety, presented J. P. Petersen, timekeeper at the plant, with a gold watch in token of the 25th anniversary of his service with the company.

Other speakers were L. E. DeCamp, sales manager, of Chicago, and W. M. Powell, safety director for the company. A demonstration of artificial respiration was given by Messrs. Espy, Ommen and Graham.

Two boxing bouts were put on, the heavyweights being Louis Brasky vs. Jos. Brasky, and the welterweights, Paul Sereg, Jr., and Anthony Bubrick. Frank Wiser refereed and Oliver Shumard and Harold Espy acted as judges. Both decisions were draws.

Music and the serving of refreshments followed.

Fire Breaks Out in Bag Room of Allentown Plant

Several employes had narrow escapes from serious injury when fire broke out in the bag room of the Allentown Portland Cement Company at Evansville, Pa., August 5.

The flames were brought under control after considerable damage had been done to the interior, but not enough to prevent operation of the plant.

Ernst Escapes Death When Car Overturns Into Ditch

William Ernst, chief chemist at the South Dakota state cement plant at Rapid City, S. D., narrowly escaped death when his car overturned a few miles south of Mason City, Iowa, on August 15.

Mr. and Mrs. Ernst had just left Rapid City the day before and were on their way to Mr. Ernst's boyhood home in New Jersey to attend a family reunion. A puncture in one of the rear tires is believed to have been the cause of the car leaving the road and overturning into a shallow ditch.

Mrs. Ernst suffered a fractured collarbone and Mr. Ernst is nursing a wrenched back, lacerations on the left arm and bruised muscles in the right arm. The body of the car, a new Chrysler sedan, was demolished.

Latimer Leaves Nebraska Company to Join Dewey

B. J. Latimer, formerly superintendent of the Nebraska Cement Company's plant at Superior, Nebr., has joined the forces of the Dewey Portland Cement Co. as efficiency engineer.

During the past year Mr. Latimer has been doing a similar job for the Marquette Cement Manufacturing Co. Before going to Superior he was with the Southwestern Portland Cement Co. at the El Paso, Texas, plant.

Jellick Tells Kiwanians of Cement Industry

"Putting a Mountain Through a Sieve" was the subject of a talk, illustrated with motion pictures, given by J. E. Jellick of the Calaveras Cement Company, before the Kiwanis Club of Sonoma, Calif., on July 28.

Turner, Plaster Expert, Joins Three Forks Company

A. M. Turner, plaster expert, has accepted a position with the Hanover plant of the Three Forks Portland Cement Company, and will be in charge of plaster operations.

Before joining the company, Mr. Turner had extensive plaster experience in the West and had served in a consulting capacity for various mills in Colorado, Wyoming and California.

Northwestern States Holds Golf Party

About 100 customers of the Northwestern States Portland Cement Company were guests at the second annual golf party of the company at the Mason City Country Club on July 31. Leslie H. Somes of the sales department was in charge of arrangements.

Attendance was drawn from Iowa, Minnesota, Wisconsin, Nebraska, and North and South Dakota.

Golf was followed by dinner and singing. There was no formal program.

Mill Equipment

Patent Issued on Amsco Nickel Manganese Steel Welding Rod

Patent on the Amsco nickel manganese steel welding rod, secured in July by Frank A. Fahrenwald, has been assigned to the American Manganese Steel Co., Chicago Heights, Ill.

The rod is said to be widely used now in the repair of manganese steel castings and the reclamation of such manganese steel equipment as dipper teeth, crusher mantles and jaws, railway track members, etc., as well as for these purposes on parts of ordinary steel and also for a wear resistant coating on almost any kind of steel casting.

The outstanding features of the welding rod are as follows, according to the manufacturer:

First, perfect welds can be made by relatively unskilled operators.

Second, when the rod is melted in the atmosphere and applied to ferrous metal articles, it exhibits the essential characteristics of standard heat treated manganese steel, namely toughness, ductility, resistance to abrasion and hardening under cold working.

Third, the high nickel content (approximately 5 per cent) overcomes any tendency of the metallic manganese content of the rod to oxidize and prevents embrittlement under slow cooling, which the rather high carbon content might cause in the absence of the high nickel content.

Fourth, the patent claims granted are very broad covering ranges of all principal elements as follows:

	Per cent
Iron	90.00 to 25.00
Manganese	5.00 to 25.00
Carbon	0.50 to 2.00
Nickel	0.25 to 50.00

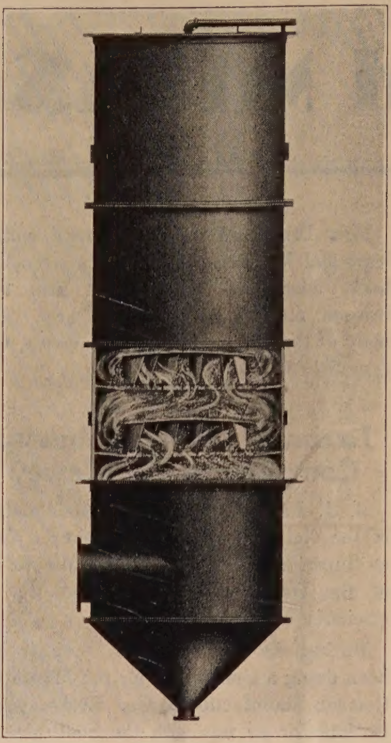
Multi-Wash Dust Collector Is Placed on Market

What is claimed to be a new wet type dust collector of exclusive, patented design and with many new operating features has been placed on the market by Claude Schneible, Chicago.

The Multi-Wash dust collector has been simplified to eliminate all moving parts, spray nozzles, pockets and dead zones, it is stated. Dust-laden air is introduced at the bottom of the tower and at a tangent to the periphery. The absorbing media introduced at the top of the tower falls in a spray through succeeding plates of the tower, giving an intense, intimate contact with the upward moving air or vapor which has continued to spiral in its course due to the vanes in each plate.

The cleaning action is illustrated by the cut-away view. Clean air escapes from the top of the tower and can be returned into the plant or exhausted into the atmosphere.

Multi-Wash collectors may be built of steel, aluminum, copper, wood, enameled cast iron, monel metal.



Cutler-Hammer Makes New Explosion Proof A. C. Starter

A new, explosion proof, across-the-line, automatic starter for A. C. squirrel cage induction motors is announced by Cutler-Hammer, Inc., Milwaukee, Wis.

Distinguishing this new starter from similar explosion proof equipment is the immersion in oil of its new thermal overload mechanism. It differs from the usual immersed oil dash pot relay and three-pole magnetic contactor in that a newly designed thermal overload mechanism is used with the contactor.

The contacts of this new starter open under a 6-in. head of oil. A special provision is made for bringing all incoming wires to the terminals below the oil level. A float operated oil indicator shows the oil level. Threaded conduit openings and a compound filled junction box are included.

The supporting structure is arranged for wall mounting and the tank is easily removed.

About the Manufacturers of Equipment

Industrial Literature

Combustion Steam Generator

Combustion Engineering Corporation, New York City, has just issued *Catalog SG*-1, describing the *Combustion Steam Generator*, which is a single unit embodying in an integral design the several elements required in the production of steam. The purpose of this design is to so coordinate the functions of the various elements as to insure maximum efficiency with minimum operating and maintenance costs, it is stated.

The Combustion steam generator is available in 8 standard sizes providing a wide range of capacities for any desired steam pressure and temperature. Pulverized fuel is introduced at the four corners of a completely water-cooled furnace and is burned with intense turbulent mixing action. The gases leaving the furnace pass through the superheater at the top of the furnace, thence through a bank of convection tubes and finally through a plate-type air preheater, to the chimney. A novel arrangement provides for regulating the temperature of the superheated steam under all conditions of operation, according to the manufacturer.

The catalog is well illustrated and includes overall dimensions of the 8 sizes of steam generators.

Small Motor Drive Reducers

A bulletin has just been issued by *W. A. Jones Foundry and Machine Company*, Chicago, Ill., on their new double reduction Herringbone-Maag speed reducers for small motor drives. In design, construction and manufacture, these small machines are said to be the same as their heavy duty reducers.

Double helical gears, accurately generated right and left hand, in effect a herringbone gear with a wide gap, are used for the initial, or high speed, reduction.

An extensive list of ratios is carried in stock to assure prompt deliveries. To those who are interested in small Herringbone-Maag reducers, the manufacturer will send this descriptive bulletin, *Number* 53.

G-E Industrial Control Catalog

Industrial Control Catalog GEA-606C, published by the *General Electric Company*, Schenectady, N. Y., comprises 196 pages and furnishes information on representative lines of industrial control manufactured by the company.

It also includes instructive matter on the care and operation of control devices; wiring diagrams of standard controllers, push buttons, and other accessories; reference tables; list of publications, and other useful information.

Field Activities

New Stedman Offices

Following its entry into the swing hammer mill field with a complete line of swing and ring hammer crushers, grinders, and pulverizers, *Stedman's Foundry & Machine Works*, Aurora, Ill., announce the opening of offices in the following additional cities: Pittsburgh, Charleston, W. Va.; Kansas City, Mo.; Chicago, and Vancouver, B. C.

Goggin & Mills are the Stedman representatives in Chicago. They are located at 407 South Dearborn Street.

In Pittsburgh, the representative is *Louis Mardaga*. His office is at 710 Park Building.

J. Y. Riffe, located at 811 Peoples Bank Building, will represent the company in Charleston, W. Va.

S. D. Calloway, of 3029 Roanoke Road, will represent Stedman in Kansas City, Mo.

In Vancouver (British Columbia), the representatives are *Brown, Fraser & Company, Limited*. Their office is at 1150 Homer Street.